

VOCABULARY

Perpendicular bisector of a triangle

Concurrent lines

Point of concurrency

Circumcenter of a triangle

Angle bisector of a triangle

Incenter of a triangle

VOCABULARY

Median of a triangle

Centroid of a triangle

Altitude of a triangle

Orthocenter of a triangle

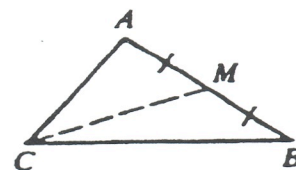
4-7 Medians, Altitudes, and Perpendicular Bisectors

Objectives: Apply the definitions of the median and the altitude of a triangle and the perpendicular bisector of a segment. Apply the theorem about a point on the perpendicular bisector of a segment, and the converse. Apply the theorem about a point on the bisector of an angle, and the converse.

median of a triangle

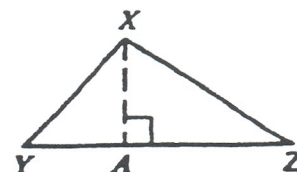
A segment from a vertex of a triangle to the midpoint of the opposite side is a median.

\overline{CM} is a median of $\triangle ABC$ since M is the midpoint of \overline{AB} .

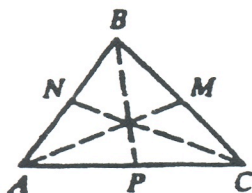


altitude of a triangle

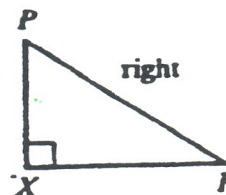
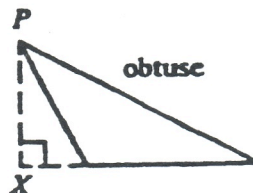
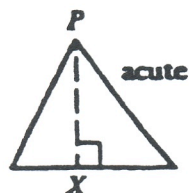
A segment from a vertex of a triangle perpendicular to the line that contains the opposite side is an altitude. \overline{XA} is an altitude of $\triangle XYZ$ since $\overline{XA} \perp \overline{YZ}$.



Every triangle has three medians and three altitudes. The medians of a triangle are always inside the triangle. However, an altitude of a triangle can be inside, outside, or part of the triangle.



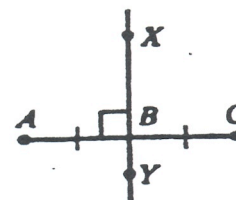
\overline{AM} , \overline{BP} , and \overline{CN} are all medians of $\triangle ABC$.



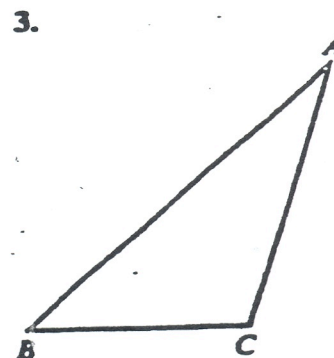
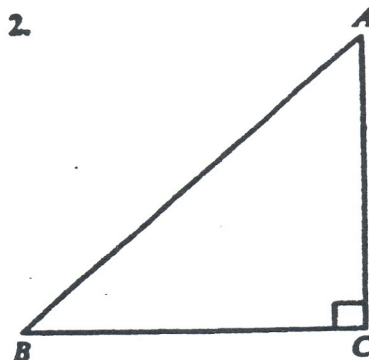
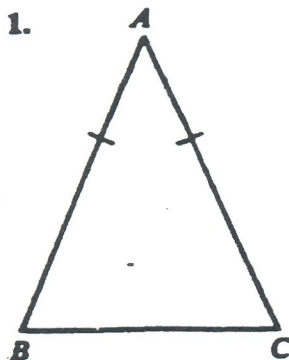
\overline{PX} is an altitude in each of the triangles. In right $\triangle PQR$, \overline{XR} is also an altitude.

perpendicular bisector of a segment

A line, segment, or ray perpendicular to a given segment at its midpoint is a perpendicular bisector of the segment. \overleftrightarrow{XY} , \overrightarrow{YX} , \overrightarrow{XY} , and \overline{XY} are all perpendicular bisectors of \overline{AC} .



For each triangle below, draw the median from A , the altitude from A , and the perpendicular bisector of \overline{AB} .



Study Guide

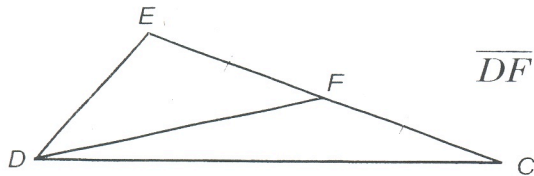
5.3 Blue

Medians

A **median** is a segment that joins a vertex of a triangle and the midpoint of the side opposite that vertex. The medians of a triangle intersect at a common point called the **centroid**. An important theorem about medians and centroids is as follows.

The length of the segment from the vertex to the centroid is twice the length of the segment from the centroid to the midpoint.

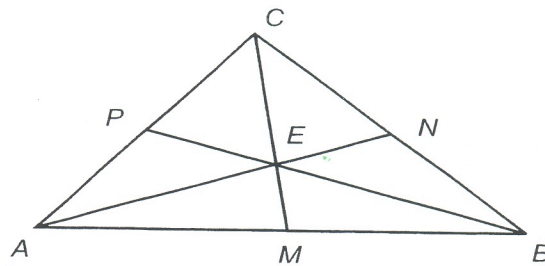
Example:



\overline{DF} is a median of $\triangle DEC$.

In $\triangle ABC$, \overline{AN} , \overline{BP} , and \overline{CM} are medians.

- If $BP = 10$, find BE .
- If $EM = 3$, find EC .
- If $EN = 12$, find AN .
- If $CM = 3x + 6$ and $CE = x + 12$, what is x ?
- If $EN = x - 5$ and $AE = x + 17$, find AN .



Draw and label a figure to illustrate each situation.

- $\triangle NRW$ is a right triangle with right angle at N . \overline{NX} is a median of $\triangle NRW$.
- \overline{OQ} is a median of $\triangle POM$.

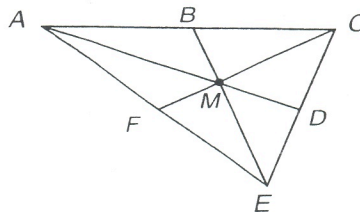
Skills Practice

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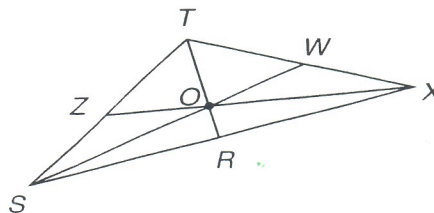
Medians

 \overline{AD} , \overline{BE} , and \overline{CF} are medians of $\triangle ACE$.

1. If $AE = 24$, find AF .
2. Find AE , if $FE = 15$.
3. What is BC if $AC = 36$?
4. Find CE , if $DE = 7$.
5. What is CD if $CE = 68$?
6. If $AF = 3$, find AE .

 **\overline{TR} , \overline{ZX} , and \overline{SW} are medians of $\triangle TXS$.**

7. If $TX = 18$, find TW .
8. If $TO = 26$, find OR .
9. If $WO = 5$, find OS .
10. Find ZO if $OX = 50$.
11. What is TZ if TS is 2?
12. What is OS if OW is 9?

 **\overline{RN} , \overline{PM} , and \overline{LO} are medians of $\triangle LNP$.**

13. What is LP if RL is 4?
14. Find AO if $LO = 18$.
15. What is RA if AN is 42?
16. If $MA = 13$, find MP .
17. Find AN if $RN = 30$.
18. If $LO = 15$, find AO .

